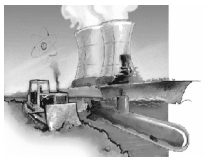
Waste Inspection Tomography (WIT)



Developer: Bio-Imaging Research, Inc.
Contract Number: DE-AC21-93MC30173
Crosscutting Area: CMST

Mixed Waste FOCUS AREA

Problem:

Characterization of the contents of nuclear waste drums is required for disposition decisions, safe transportation, and permanent storage. Movement of waste drums on and off storage sites is regulated for safety and environmental reasons. Examination of contents with invasive techniques is expensive because of the safety precautions necessary when handling nuclear waste. Currently used non-destructive techniques such as real time radiography (RTR) lack the capability of identifying regulated contents such as free liquid volume. Thus, characterization of nuclear waste is logistically difficult, expensive, and generally does not provide quantitative results.

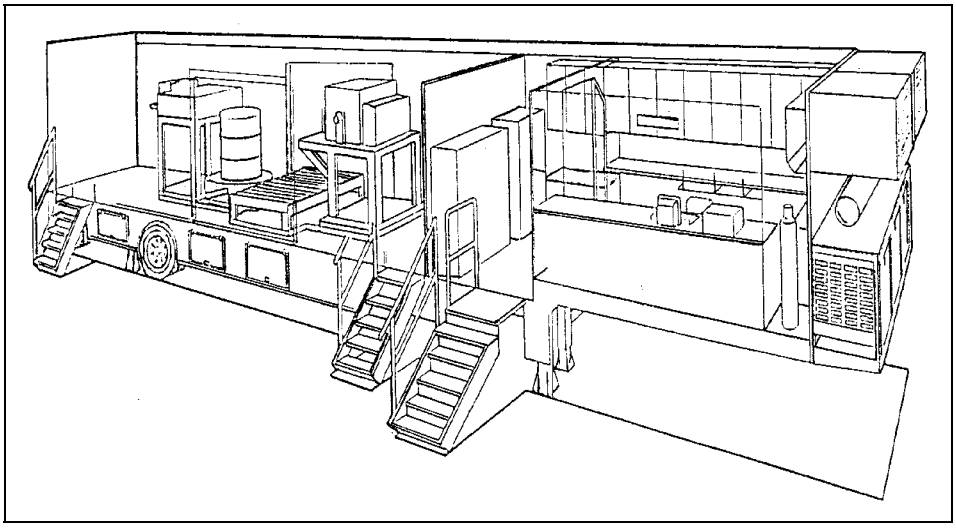
Solution:

A mobile waste inspection tomography (WIT) system that can be brought to the waste site to perform tomographic characterization of nuclear waste drums using a multimodality approach. In the WIT system, high-energy computed tomography (CT), emission tomography (ECT or SPECT, for single photon ECT), and emission spectroscopy for nondestructive assay (NDA) are integrated on a mobile trailer. WIT is nondestructive and noninvasive, and produces quantitative results. WIT will safely and cost-effectively identify contents, provide two- and three-dimensional information about contents, locate isotope emissions, and identify the emitting isotope species.

- Effective for low level, transuranic, and mixed wastes in a variety of matrices including ○cement, glass, polymers, combustibles, loose soil, heterogeneous metals, and super-compacted materials.

- Mobile system optimizes logistics.

- 3-D, readily interpreted, near real-time images of drum contents facilitates evaluation, processing, and disposition of drums.



Benefits:

- Rapid characterization of 55-110 gallon drums for radioactive and heavy metal content and location, wall thickness, free liquid volume and location.

- Archived data and content images support engineering decisions and regulatory compliance.

Technology:

The WIT design provides the following imaging capabilities in a mobile system with reasonable throughput and cost. CT nondestructively quantifies regulated parameters. This includes measurements of drum-wall thickness and free liquid volume, and identification of heavy metal densities. CT also identifies drum contents through 2-D and 3-D imaging. ECT can locate emissions, within a drum, identifying a point source, a locus of points, or a uniform distribution of emissions. NDA identifies the emitting isotopic species. The WIT system also has the capability to characterize containers up to 42 inches high by 32 inches wide.

The following are important features of the WIT system:

Mobile Trailer: Includes a 48-foot long air-ride trailer with control equipment; scanner rooms; radiation shielding and safety interlocks; intercom and closed circuit TV; HVAC; an electrical generator with alternate connection to a local power source; and fire suppression and security systems.

Drum Handling: Loading and unloading will be accomplished using site-supplied forklift trucks. Overpack protection for older or breached drums is required.

CT: A 2 MeV CT scanner with digital radiography capability, including motion control for drum manipulation during scanning and high-speed data collection for volume imaging.

ECT: Gamma cameras provide for emission volume imaging to locate emission sources within the drum.

Spectroscopic Assay: Energy sensitive nondestructive assay reveals the emission spectrum, identifying the emitting isotopic species. Capability for active and passive CT is also provided to allow validation of the system. Lawrence Livermore National Laboratory (LLNL) is developing this technology application under a separate agreement.

Volume Display: A volume image processor and display provides CT and ECT data fusion to identify the source of the radioactive emission.

Archive Storage: Optical disk storage of digitized images and raw data, as well as VCR recording of operator review protocols, are provided.

Contacts:

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DOE's Morgantown Energy Technology Center supports the Environmental Management - Office of Science and Technology by contracting the research and development of new technologies for waste site characterization and cleanup. For information regarding this project, the DOE contact is:

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